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Relative RF Power Meter

Add this handy device to your shack's arsenal.

The Relative RF Power Meter shown in ***Photo A*** *is a piece of test equipment useful for tuning RF circuits to maximum output power. The circuit does not measure absolute power, however; it instead measures the relative output power as the RF circuit is tuned.*

When the meter shows maximum deflection, the output power is peaked. The meter has been tested from 2 MHz to 1 GHz over an input power range of approximately –10 dBm (0.1 mW) to 20 dBm (100 mW).

To use this instrument, the source resistance of the circuit being measured must be 50 ohms.

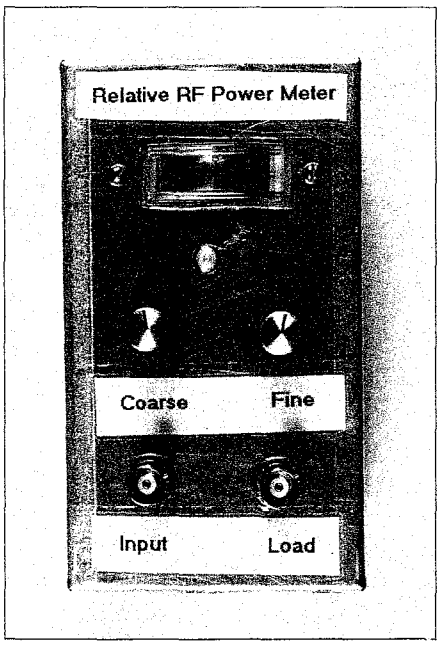

Photo A. *Front panel view.*

Circuit description

Fig. 1 shows the schematic diagram for the Relative RF Power Meter. J1 is the RF input. J2 is the connector for the 50-ohm terminator. The RF signal enters at J1, is rectified by D3, and filtered by FB1 and FB2, and charges C1. R11, R10, and R3 form a voltage divider which determines the meter's sensitivity to input power. Overvoltage protection of U1's input is provided by R9 and D2. The gain of U1 is set at about 200. Offset voltage is eliminated by adjusting R5. R1 and R2 form a voltage divider with the center connection used as a ground. When the meter is turned on, D1 is illuminated.

Construction

First, drill holes in the front of the case for J1, J2, R11, R10, and the LED clip. Use a nibbling tool to cut a hole

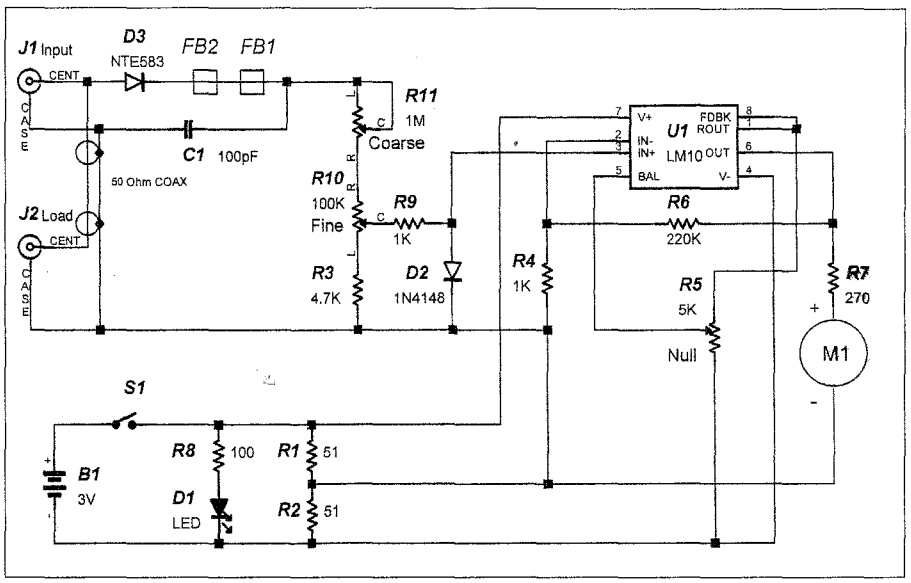

Fig. 1. *Relative RF power meter schematic.*

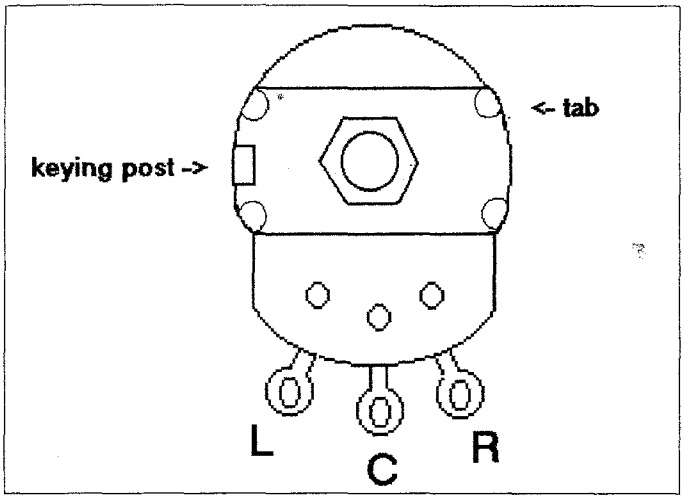

Fig. 2. Potentiometer designations.

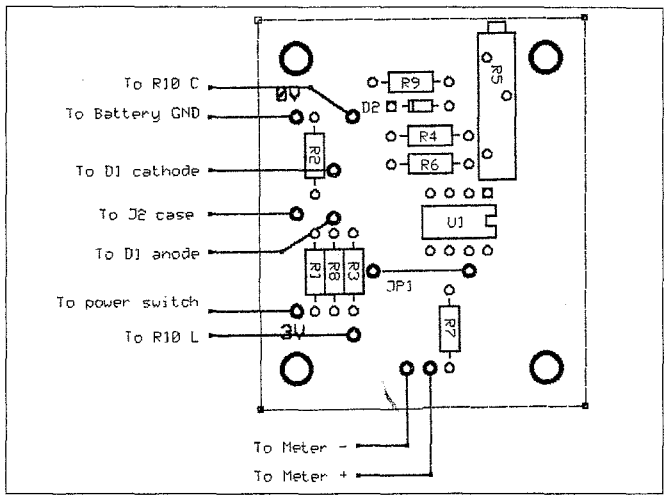

Fig. 4. Parts placement.

for the meter, and drill the holes for mounting it. Next, cut 1.25" of shaft length from R10 and R11. Break off the keying posts with pliers (refer to **Fig. 2**). Bend the tabs back on R11 and remove its case. Install the potentiometer switch S1 on R11. Mount the above mentioned components in the previously drilled holes.

Use two screws and nuts to secure the meter. Attach the knobs to R10 and R11. Solder J1, J2, S1, D3, C1, R10, and R11 point-to-point according to the schematic diagram shown in **Fig. 1**. Notice that J1 and J2 are connected with a short piece of 50-ohm coax, and the positive battery holder lead is connected to S1. When connecting D3, be sure the cathode lead passes through FB1 and FB2. Refer to **Fig. 2** to determine the potentiometer mounting designations. Keep all connecting leads as short as possible.

Fig. 3 is a full-size positive artwork for making the printed circuit board. When the board is developed, the text "PCF01RFM" should appear on the

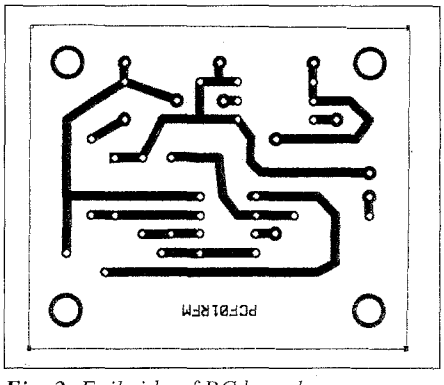

Fig. 3. Foil side of PC board.

Part	Description	RadioShack.com	Mouser
FB1, FB2	ferrite bead	900-5003	
J1, J2	BNC female		161-9323
B1	battery holder 2XAAA	910-0326	122-0421
S1	potentiometer switch	271-1740	
D1	green LED	900-6089	512-HLMP4740
D2	1N4148	900-2908	583-1N4148
D3	NTE583	901-0288	
R1, R2	51 Ω 1/4 W 5%	900-0187	291-51
R3	4.7k 1/4 W 5%	900-0234	291-4.7k
R4, R9	1k 1/4 W 5%	900-0218	291-1k
R5	5k multiturn pot		652-3006P-502
R6	220k 1/4 W 5%	900-0274	291-220k
R7	270 Ω 1/4 W 5%	900-0204	291-270
R8	100 Ω 1/4 W 5%	900-0194	291-100
R10	100k 1T pot	271-092	
R11	1 meg 1T pot	271-211	
C1	100 pF	900-2201	140-50P2-101K
U1	LM10CN or LM10CLN	900-6306	
M1	meter	910-0398	
Case	5.25 x 3 x 2.125 in.	270-238	537-TF-780
Knobs (2)	knobs for 1/4-in. shaft	900-2531	
Load	BNC 50 Ω terminator	910-0557	177-3161
Spacers (4)	nylon 1/2-in. 4-40		561-TSP3
LED clip	LED clip	900-6151	606-CMP22
8-pin socket	socket	900-5740	575-199308
Screws (10)	1/4-in. 4-40		
Nuts (2)	4-40		
50 Ω coax	3.5 in.		
#26 wire	hookup wire		
2-sided tape	adhesive tape		
AAA batteries (2)	batteries		

Table 1. Parts list.

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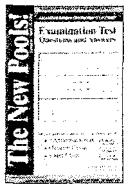

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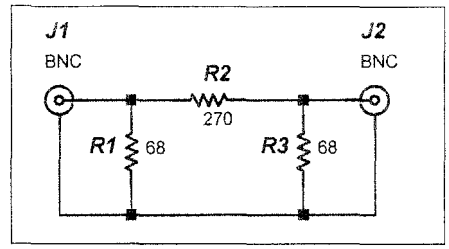

Fig. 5. 20 dB attenuator. R1 and R3 are 68 ohm 10 W carbon composition or noninductive resistors. R2 is a 270 ohm 2 W carbon composition or noninductive resistor.

copper side, not the mirror image. All component holes are 0.031 inches in diameter. The PCB mounting holes are 1/8 inch in diameter.

Fig. 4 shows the placement of parts on the circuit board and the wiring connections from the circuit board to the front panel. **Table 1** lists a description of these parts. Use a socket for U1 and don't forget to solder jumper wire JP1. Once the circuit board is assembled and the front panel connections are made, verify the correct orientation of D1, D2, D3, U1, and M1. Drill holes in the back of the case to mount the circuit board, and leave room to mount the battery holder. Attach the battery holder to the back of the case with two-sided adhesive tape. A view of the completed inside of the instrument is shown in **Photo B**.

Insert new batteries and turn on the power by rotating the Coarse potentiometer clockwise. The green LED should turn on. Turn the Coarse and Fine controls both completely clockwise and null the offset voltage by adjusting R5 until the voltage across M1 measures zero volts. Next, use the four spacers to mount the circuit board to the back of the case.

Use

To use the Relative RF Power Meter, follow these steps:

1. Attach a 50-ohm terminator to J2.
2. Connect an RF input signal to J1 (must have a 50-ohm source resistance).
3. Set the Fine adjustment to 1/2 rotation.
4. Click the power on by rotating the Coarse adjustment clockwise.
5. Adjust the Coarse and Fine controls to center the meter needle. Note: If the meter shows full-scale deflection regardless of the Coarse and Fine settings, the input signal amplitude is too large to measure. If the meter reads no deflection regardless of these settings, then the input signal is too small.
6. Tune the RF circuit for a peak meter reading (if the reading is full-scale then go back to Step 5).

If the green LED does not glow at all when the unit is turned on, then the instrument needs fresh batteries. In order to measure higher input power, simply use an attenuator. **Fig. 5** shows an example of a 20 dB attenuator that, when connected to the input of the Relative RF Power Meter, will allow relative power measurements to 40 dBm (10 W). 73

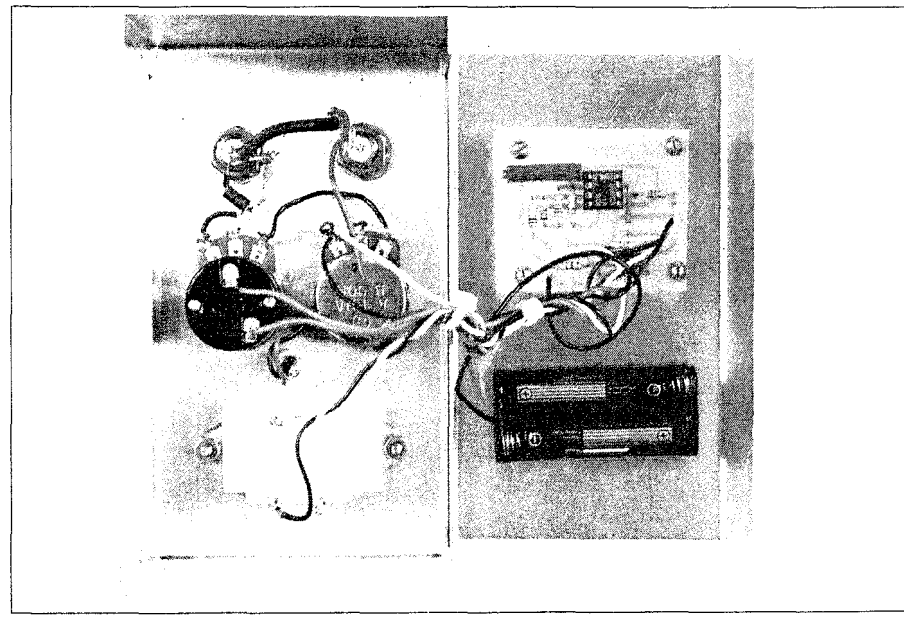

***Photo B.** Inside of case.*